The “TEVAR-First” approach to Type A Aortic Dissection with Mesenteric Malperfusion

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Disclosures

• Medtronic-Speakers Bureau
Type A with Mesenteric Malperfusion
IRAD Experience

• 4% of Type A Dissections

• Standard of Care
  1. Emergent proximal aortic replacement
  2. Open or endovascular revascularization

• In Hospital Mortality: 63%
  (n=68)

Clinical presentation, management, and short-term outcome of patients with type A acute dissection complicated by mesenteric malperfusion: Observations from the International Registry of Acute Aortic Dissection

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Background: Few data exist on clinical/imaging characteristics, management, and outcomes of patients with type A acute dissection and mesenteric malperfusion.

Methods: Patients with type A acute dissection enrolled in the International Registry for Acute Dissection (IRAD) were evaluated to assess differences in clinical features, management, and in-hospital outcomes according to the presence/absence of mesenteric malperfusion. A mortality model was used to identify predictors of in-hospital mortality in patients with mesenteric malperfusion.

Results: Mesenteric malperfusion was detected in 68 (3.7%) of 1809 patients with type A acute dissection. Patients with mesenteric malperfusion were more likely to be older and to have coma, cerebrovascular accident, spinal cord ischemia, acute renal failure, limb ischemia, and any pulse deficit. They were less likely to undergo surgical/hybrid treatment (32.9% vs 87.9%) and more likely to receive only medical (30.9% vs 11.6%) or endovascular (16.2% vs 0.5%) management (P < .001). Overall in-hospital mortality was 63.2% and 23.8% in patients with and without mesenteric malperfusion, respectively (P < .001). In-hospital mortality of patients with mesenteric malperfusion receiving medical, endovascular, and surgical/hybrid therapy was 95.2%, 72.7%, and 41.7%, respectively (P < .001). At multivariate analysis, male gender (odds ratio [OR], 1.7; P = .002), age (OR, 1.11; P = .002), and renal failure (OR, 5.9; P = .020) were predictors of mortality whereas surgical/hybrid management (OR, 0.1; P = .005) was associated with better outcome.

Conclusions: Type A acute aortic dissection complicated by mesenteric malperfusion is a rare but ominous complication carrying a high risk of hospital mortality. Surgical/hybrid therapy, although associated with 2-fold hospital mortality, appears to be associated with better long-term outcomes in the management of type A acute aortic dissection in this setting. (J Thorac Cardiovasc Surg 2013;145:385-90)

Type A with Mesenteric Malperfusion
Michigan Algorithm

1. Endovascular reperfusion
   - Percutaneous fenestration
   - Aortic true lumen bare metal stent
   - +/- Branch vessel stent
2. Stabilization
3. Delayed proximal aortic replacement

In Hospital Mortality: 41% (n=37)

Type A with Mesenteric Malperfusion

Emory “TEVAR-First” Algorithm

1. TEVAR +/- branch vessel stenting
   – Rapidly restore distal aortic true lumen perfusion
   – Avoid circulatory arrest

2. Stabilization

3. Delayed proximal aortic reconstruction (24-48 hrs)

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The “TEVAR-First” Approach to DeBakey I Aortic Dissection With Mesenteric Malperfusion

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Acute DeBakey type 1 aortic dissection presenting with mesenteric malperfusion is a lethal variant of all dissection-related malperfusion syndromes with reported mortality rates of 38% to 75%. Conventional surgical treatment involves proximal aortic replacement to restore true lumen perfusion, followed by mesenteric revascularization if malperfusion persists. In an attempt to improve the dismal outcomes associated with this malperfusion syndrome, we have instituted a [thoracic endovascular aortic repair] “TEVAR-First” approach in hemodynamically stable patients, which allows for earlier true lumen expansion and resolution of the malperfusion syndrome.

(Ann Thorac Surg 2014;97:693-6)

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Type A with Mesenteric Malperfusion Challenges

• **Diagnosis:**
  – History: Abdominal pain
  – PE
    • ABD: Pain out of proportion
    • Pulses: Palpable femoral pulses does not rule out
  – CT scan:
    • Massive TL compression throughout the visceral segment
    • Dissection of celiac or SMA
    • Contrast enhancement of celiac or SMA does not rule out
  – Labs: Elevated LFT’s or lactate level
Type A with Mesenteric Malperfusion

**ETIOLOGY of PROBLEM**

- Massive TL compression in DTA and Abdominal Aorta due to dynamic flap
- Inflow problem to the distal aorta
- Insufficient flow to Celiac and SMA vascular beds
Stage I: TEVAR Principles

- **Goal of TEVAR**
  - Stent open TL
  - Increase inflow to visceral segment
  - **NOT to cover primary tear**

- **Graft size:**
  - Aortic diameter of proximal DTA
  - 0-10% oversizing

- **Proximal LZ**
  - Prox DTA

- **Extend TEVAR to Celiac if necessary**
- **Branch vessel stenting**
Stage II: ICU Resuscitation and Reperfusion

- Extubate patient
- Aggressive IV fluid resuscitation
- Serial abdominal exams
- **NORMALIZE LACTATE!**
Stage III: Proximal Aortic Reconstruction

- 24-48 hours after TEVAR
- Minimize CPB & HCA time
  - Visceral organs remain at risk for I/R injury
  - Hemiarch preferable
  - Root repair preferable

Goal: Alive patient in the ICU with normal renal function!
Type A with Mesenteric Malperfusion
TEVAR-First Approach

Case Presentation
Type A with Mesenteric Malperfusion

- 53 yo morbidly obese female presents to an OSH with severe abdominal and right leg pain
- Transferred to Emory
- On arrival, complaining of abdominal pain
- PE
  - ABD: Soft, tender to palpation in the epigastrum
  - Cool, pulseless right leg
- Cr. 2.1
- “Pain out of proportion” to exam
Stage I: TEVAR + Peripheral Stent

- Hybrid room
- Open exposure of R femoral artery (pulseless)
- 5 Fr Sheath in L CFA
- Pressure Measurements
  - R Radial (Thoracic TL)
  - ABD TL
  - Femoral arteries
    - Right: 45/28 mm Hg
    - Left: 117/60 mm Hg

Physiologic Proof of Mesenteric Malperfusion!
Type A with Mesenteric Malperfusion

IVUS

Thoracic+ABD Aorta

Visceral segment
Type A with Mesenteric Malperfusion
Aortograms
Post TEVAR Aortograms

Robust Visceral perfusion…R renal malperfusion!
Type A with Mesenteric Malperfusion
Post TEVAR IVUS

Thoracic + ABD Aorta

Visceral Segment
Post-TEVAR

- ABD TL: 101/52 mmHg
- R femoral
  - Palpable pulse
  - Pressure: 101/52 mm Hg

Malperfusion Resolved!
Angiographic and Physiologic
Stage II: ICU Resuscitation and Reperfusion

- Extubated
- Neurologically intact
- 6 liters of IV fluid
  - Normalization of Lactate level
- 24 hours later, Proximal aortic replacement
  - Anxious time period
  - Keep pain free
  - SBP<120-140 mm Hg
Stage III: Proximal aortic replacement

- Aortic root replacement
  - 6cm root aneurysm
- Ascending aortic replacement
- Subtotal arch replacement
  - Large arch tear in Zone 2
  - Distal anastomosis at LSA
  - Reimplanted Innominate and LCCA
  - DID NOT SEW to TEVAR graft
Type A with Mesenteric Malperfusion

Results

<table>
<thead>
<tr>
<th></th>
<th>TEVAR – 1\textsuperscript{st} Proximal Aortic Reconstruction</th>
<th>Proximal Aortic Replacement with Antegrade TEVAR (n=6)</th>
<th>Proximal Aortic Replacement and Laparotomy (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>47±11</td>
<td>57±14</td>
<td>56±13</td>
</tr>
<tr>
<td>Root Replacement</td>
<td>3 (43%)</td>
<td>1 (17%)</td>
<td>1 (10%)</td>
</tr>
<tr>
<td>Hypothermic Circulatory Arrest</td>
<td>11 (100%)</td>
<td>6 (100%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>Persistent Mesenteric Ischemia</td>
<td>0</td>
<td>4 (67%)</td>
<td>6 (60%)</td>
</tr>
<tr>
<td>Mortality</td>
<td>3 (27%)</td>
<td>4 (67%)</td>
<td>6 (60%)</td>
</tr>
</tbody>
</table>

Mortality: 1. Large stroke after Proximal aortic repair
2. Hematologic reaction upon separation from CPB (Redo)
3. Interval Rupture 7 days after TEVAR (Redo)
EMORY Treatment Algorithm for Type A with Mesenteric Malperfusion

**Diagnosis**

If Hemodynamically stable and:
- NO Pericardial effusion
- NO Ongoing chest pain
- NO Signs of rupture

TEVAR with angiographic evidence of Celiac and SMA reperfusion

ICU Resuscitation/Reperfusion

Resolution of abdominal pain and lactic acidosis

Delayed proximal aortic replacement in 24/48 hours

If Hemodynamically unstable or signs of rupture

Emergent proximal aortic replacement + Antegrade TEVAR

Persistent abdominal pain and lactic acidosis

Exploratory laparotomy NO Aortic surgery
“TEVAR-First” Approach to Type A with Mesenteric Malperfusion

- Avoidance of circulatory arrest to ischemic visceral organs!!
- Bridge to decision
- Improved outcomes
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Post-op Course

- Pneumonia
- Tracheostomy
- Renal function normalized
- Neurologically Intact
- Ambulating and tolerating diet
- D/C on POD #33, Cr. 0.9
Type A with Mesenteric Malperfusion

• Why are results improved with primary endovascular therapy and delayed proximal aortic replacement?

REPERFUSION OF ISCHEMIC VISCERAL ORGANS WITHOUT THE SEVERE ISCHEMIC INSULT OF CIRCULATORY ARREST!